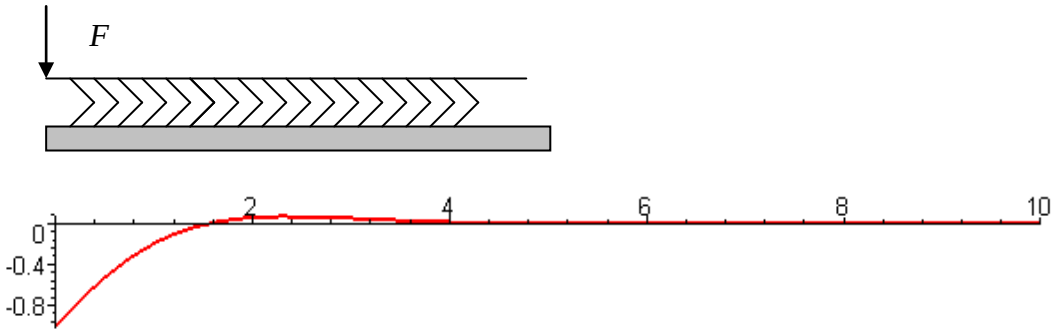
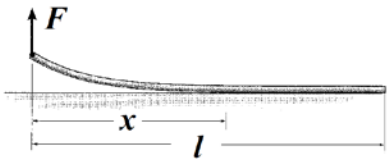
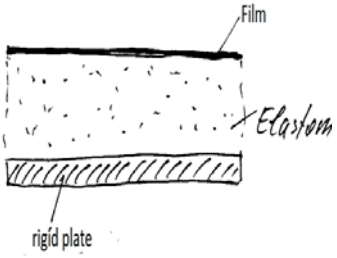
I. Winkler`s foundation. A rail is supported with a series of springs with the stiffness α per unit length (elastic foundation). At its end, a force F is applied. What shape assumes the rail under this load?

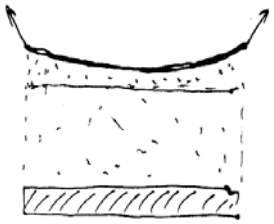


II. A thin, flexible rod lies on a smooth horizontal surface. What length x of the rod will take off under the action of a vertically oriented force F, applied at the end of the rod?
What shape has this section?



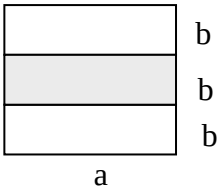
III. A composite consists of a rigid base, an elastic layer and a film that can be assumed to be inextensible. What form will assume the film when trying to tear it off? The length of the composite be L is, and it is pulled symmetrically on both sides. The displacements and the slope of the film in the deformed state is assumed to be very small everywhere.





IV. Determine the bending stiffness of a beam consisting of three plates with elastic moduli E_1, E_2, E_1.

Cross-section:



V. With a thorn of a plant, the experiment shown below was performed. Determine the elastic modulus of the material of the thorn.

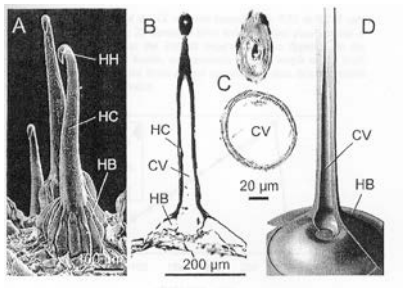
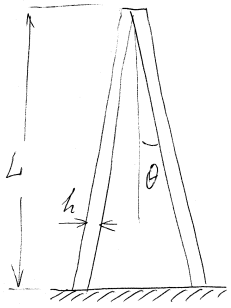


Figure 1. Hooks of *G. aparine*. A. SEM-micrograph. B, C. The longitudinal (B) and cross sections (C) at the basal (C, bottom) and apical parts of the hook (C, top) in LM. D. 3D model of the hook. CV, cavity; HB, hook base; HC, hooked cone; HH, hook head.



Experimental data:

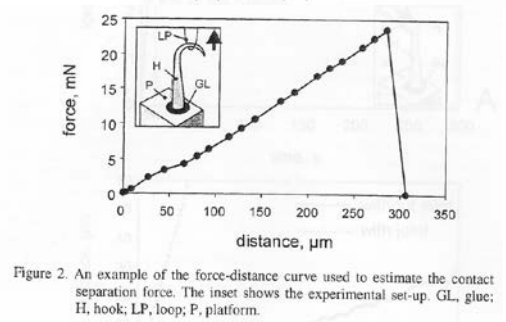


Figure 2. An example of the force-distance curve used to estimate the contact separation force. The inset shows the experimental set-up. GL, glue; H, hook; LP, loop; P, platform.

$$F = 4.15 \cdot 10^{-3}\, N$$
$$y = 2.5 \cdot 10^{-6}\, m$$
$$L = 553 \cdot 10^{-6}\, m$$
$$h = 10 \cdot 10^{-6}\, m$$
$$r_{1,\max} = 30 \cdot 10^{-6}\, m$$
$$\tan\theta = \frac{r_{1,\max}}{L} = \frac{30}{553}$$